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Patent Holder: Gembrys, Paul Richard, 6990 Bad Mergentheim, Germany

Inventor: Same as patent holder

Publications Cited in Opposition in the Examination Procedure According to Section 44 of the Patent Law:

DE-OS 31 22 617

US 3,967,626

US 3,112,792

US 2,726,658

US 1,896,953

EP 39443 A1

Book in German: U. Tietze, Ch. Schenk: Halbleiterschaltungstechnik [Semiconductor Circuits], Springer Verlag, Berlin, 1983, pages 178-180 and 577-579.

Title: Device for Therapeutic Temperature Control of Body Parts

A device for therapeutic temperature control of body parts or coverings placed on the latter, for example therapeutic mud and/or paraffin packs, contains a heat-transfer element (3) that is flexibly elastic and can be placed on the body part or the covering, said element consisting of a strip (8) traversed by at least one fluid duct (7). A supply part (1) for the fluid contains two fluid containers (20, 21), one of which is provided with a heater (22) and the other is provided with a cooler (24). Both fluid containers (20, 21) are connected by electrically controllable valve (29) with circulating pump (31). The control part (2) of the device contains an electrical circuit composed of a comparator circuit (processor 40), a memory (42), a clock (41), an input circuit (45), and an output circuit (48). A plurality of preselected temperatures can be stored in memory (42) so that the temperature of the fluid can be regulated to these preset temperatures at chronologically sequential intervals.

Claims

1. Device for therapeutic temperature control of body parts or of coverings placed on the latter, therapeutic mud and/or paraffin packs for example, with

1. a heat transfer element (3) that is flexibly elastic and can be placed on the body part or the covering, said element consisting of

1.1 a strip (8) which

1.2 is traversed by at least one fluid duct (7) uniformly;

2. a fluid container (20) which

2.1 is provided with a heater (22) and

2.2 with a cooling device (4);

3. a circulating pump (31) which

3.1 links fluid container (20)

3.2 with fluid duct (7)

3.3 through an electrically adjustable valve (29);

4. an electrical circuit which consists of

4.1 a processor (40),

4.2 a memory (42),

4.3 a clock (41),

4.4 an input circuit (45) that processes the signals derived from temperature sensors (33, 34, 35, 36) in accordance with the fluid temperature, and

4.5 an output circuit (48) which, on the basis of electrical signals from processor (40), controls heater (22), cooler (24), valve (29), and circulating pump (31), whereby

4.6 a fixed fluid temperature presettable by the user is stored in memory (42);

4.7 the temperature of the fluid can be set to the preselected temperature by heater (22), cooler (24), and/or the delivery of circulating pump (31);

characterized in that

5. a plurality of preselected temperatures can be stored in memory (42), so that the temperature of the fluid can be adjusted to these preselected temperatures at chronologically sequential intervals;

6. two fluid containers (20, 21) are provided, with

6.1 one being provided with a heater (22), and

6.2 the other being provided with a cooler (24);

6.3 both fluid containers (20, 21) are connected by valve (29) with circulating pump (31).

2. Device according to Claim 1, characterized in that the preselected temperatures are manually presettable.

3. Device according to Claim 1 or 2, characterized in that electrically controllable valve (29) is a switching-mixing valve.

4. Device according to Claim 2 or 3, characterized in that memory (42) comprises a plurality of separate temperature-adjusting elements (51) associated with sequential time intervals.

5. Device according to Claim 4, characterized in that temperature adjusting elements (51) are temperature slides located adjacent and parallel to one another.

The invention relates to a device for therapeutic temperature control of body parts or of coverings placed thereon, therapeutic mud and/or paraffin packs for example, according to the preamble of Claim 1.

It is known in the field of physical therapy to provide body parts with coverings or so-called packs for cooling or heating. As a result, body reactions are elicited by the action of the heat or cold, said reactions having an advantageous effect on circulation and the patient's psyche for example. Thus, mud baths or mud packs are applied to the human body or to individual limbs for heat treatment of internal diseases, acute inflammations, nervous diseases, etc.

For example, in order to improve the constancy of the temperature pattern for such packs even further over time, attempts have already been made in the past to apply so-called mud/paraffin or paraffin packs.

A familiar home remedy for controlling the temperature of body parts and/or the abovementioned packs is the so-called heating pad that can be placed either directly on the body part or can be placed around the packs. Regulation of the pad or pack temperature with a high degree of constancy both locally and as a function of time using electrical heating elements in conjunction with thermostats operating in the pad is only possible however by expending considerable technical effort and produces only moderate success.

As an improvement, it has already been suggested (U.S. Patent 3,967,627) to pump a heat-transmitting fluid through a system of lines from a heatable or coolable container through an elastically flexible heat transmitting element that can be placed on the body parts whose temperature is to be controlled. This did make it possible to perform physical therapy with heat or cold, but no arbitrarily adjustable temperature pattern for achieving therapeutic effects could be achieved.

European patent application EP 39 443 describes a device for cooling body parts that has an electronic memory for entering a constant treatment temperature or a final treatment temperature that is reached by continuous approximation. Heat therapy is no more feasible with this device than therapy with a temperature pattern that can be set as desired to expose body parts to an alternating temperature, temperature surges, or temperature shifts, for example.

The goal of the invention is to provide a device for therapeutic temperature control of body parts in which the temperature curve can be controlled during successive time intervals to achieve quasi-arbitrary temperatures. Essentially constant temperature curves are as easy to produce as are those that alternate more or less sharply.

This goal is achieved according to the characterizing features in Claim 1. Since a heater and/or a cooler is/are provided in the two fluid containers, these containers may have sharply different temperatures. To change the temperature of the fluid, no heating or cooling process need be started; it is merely necessary to operate the switching-mixing

valve between the two containers. Depending on the switching time of the valve, rapid temperature changes can be effected in the strips.

Advantageously, therefore, the device according to the invention can be used to keep the temperature of a pack for example essentially constant for a long period of time (the fluid system, because of its relatively high heat content, responds relatively slowly to temperature fluctuations), and it is also possible to raise or the pack temperature uniformly during a predetermined period of time. In addition, with the device, temperature patterns, surges, or drops can act at certain times on the body parts to be treated, as have been found to be optimum for treating a wide variety of illnesses.

No electrical measuring or regulating devices of any kind are required on the patient's body (or on the temperature-transmitting element), so that protection of the patient against electrical shock is considerably improved. It must be kept in mind in this connection that packs are often applied in bathrooms, where it is essential to work extremely carefully with electrical devices of all kinds.

It is also important that the therapy pattern can be established even before it begins by including a memory for the preselected temperatures. This means that it is not necessary for the operating personnel to be present during the entire period of treatment.

According to the characterizing feature of Claim 2, the desired preselected temperatures can be manually preset. Various operating elements can be used for this purpose. The

characterizing features of Claims 4 and 5 describe an especially advantageous design in this connection, very simple to operate even by untrained personnel, for preselecting temperature. The operation of the memory is particularly simple and clear if it has a plurality of separate temperature-setting elements, each of which is associated with a certain time interval. If the temperature-setting elements are designed as temperature slides adjacent and parallel to one another and in the shape of sliding potentiometers, the operation of the device is especially simple and clear even for non-experts, since the curve of temperature as a function of time can be read directly off the slide settings.

By using a switching-mixing valve in accordance with the characterizing feature of Claim 3, the therapy temperature can be regulated especially simply by the operation of this valve that is controlled by the electrical circuit.

The invention will now be described in greater detail with reference to an embodiment shown in the drawing.

Figure 1 is a schematic diagram of the important components of the device.

Figure 2 is a schematic view of the heat transfer element, and

Figure 3 is a section along A-A in Figure 2.

The device consists essentially of a supply part 1 that can be preferably mounted in a cabinet or on a rack and a control part 2, a heat transfer element that is flexibly elastic and can be wrapped around the body part, as well as hoses 4 that run between the heat transfer element and the supply and control part, namely a supply line 5 and a return line 6.

Heat transfer element 3 consists of a strip 8 uniformly traversed by at least one fluid duct 7, with a contact application surface 9 that forms the side of heat transfer element 3 that faces the body. Fluid duct 7 is mounted in good thermal contact on the back of contact surface 9 and is surrounded by a flexibly elastic contact material 10. The back 11 of heat transfer element 3 that faces away from the body is provided with a heat insulating layer 12.

Fluid supply part 1 consists of two fluid containers 20, 21, one of which is connected with an electrical heater 22 and the other is connected with a heat exchanger 23 of a cooler 24. The fluid in fluid container 20 is therefore a heating fluid 25 and that in fluid container 21 is a cooling fluid 26. Fluid containers 20, 21 are in fluidic connection with an electrical switching-mixing valve 29 through double hoses 27, 28, said valve being connected by other lines 30 to a circulating pump 31. The hoses 4 that lead to heat transfer element 3 are connected to the pump, possibly with interposition of additional pipe sections 32.

The temperature in the fluid system is measured by temperature sensors 33, 34 in supply line 5 and return line 6. Additional temperature sensors 35, 36 are located in fluid containers 20, 21 and serve in particular to keep the temperatures of heating fluid 25 and

cooling fluid 26 constant in the event that the circulation is interrupted by switching off circulating pump 31.

The device is operated by a circuit designed as a memory-programmable control that consists essentially of a processor 40, a clock 41, a manually-operable memory 42, and an electro-optical display 43. Processor 40 is connected with an input circuit 45 by a first input 44, in which input circuit for example the average of the thermovoltages of temperature sensors 33, 34 is formed and/or the thermovoltages of the other temperature sensors 35, 36 are processed for connection to input 44. Through an output 46, the processor (possibly with interposition of a power stage, not shown) is connected with circulating pump 31 and regulates its delivery as required. Switching-mixing valve 29 is regulated by another output 47 of processor 40, possibly with interposition of another power stage, not shown. Heater 22 or cooler 24 are operated through an output circuit 48 that is also connected by output lines 49, 50 with processor 40.

Processor 40 is operated in the switching mode by clock 41 that connects the content of memory 42, associated with consecutive time segments, to the processor, with outputs 46, 47 , 49, and 50 being operated in a preprogrammed fashion. Display 43 serves both to display the average temperature (average of the thermovoltages of temperature sensors 33, 34) and the treatment time still remaining for example.

Memory 42 is provided with a plurality of temperature-adjusting elements 51 that are designed as adjacent and parallel sliding potentiometers (temperature slides) and can display a curve of temperature as a function of time 52 especially easily.

Fluid channel 7 mounted on contact surface 9 is a flexible hose 55 that has a multiple branch 56 on the input side and forms a plurality of parallel individual channels 57, said channels terminating with their return ends 58 commonly in return line 6. Individual channels 57 are laid down zigzag fashion so that they cover an important part of the width of contact application surface 9 in straight segments that are parallel to one another.

Reference Numerals

1	supply part
2	control part
3	heat transmitting element
4	hoses
5	supply line
6	return line
7	fluid channel
8	application strips
9	contact application surface
10	contact material
11	back

12 heat insulating layer

20 fluid container

21 fluid container

22 heater

23 heat exchanger

24 cooler

25 heating fluid

26 cooling fluid

27 pipe

28 pipe

29 switching-mixing valve

30 additional pipes

31 circulating pump

32 pipe sections

33 temperature sensor

34 temperature sensor

35 additional temperature sensor

36 additional temperature sensor

40 processor

41 clock

42 memory

43 display

44 inputs

45 input circuit

46 output

47 additional output

48 output circuit

49 output line

50 output line

51 temperature adjusting element

52 temperature curve

55 hose

56 multiple branch

57 individual channels

58 ends

One sheet of drawings

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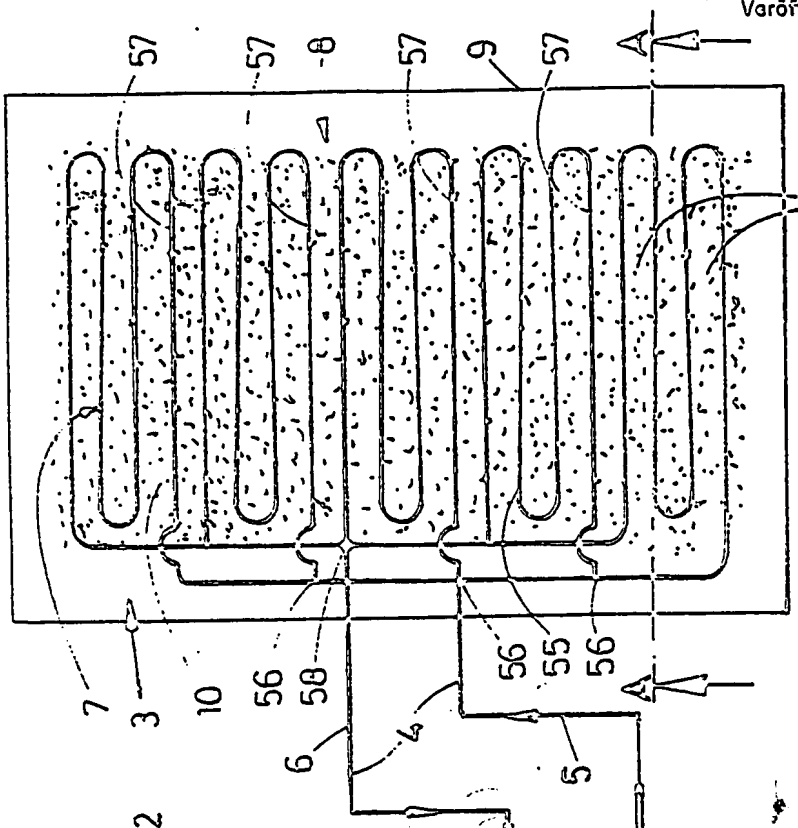

FIG. 2

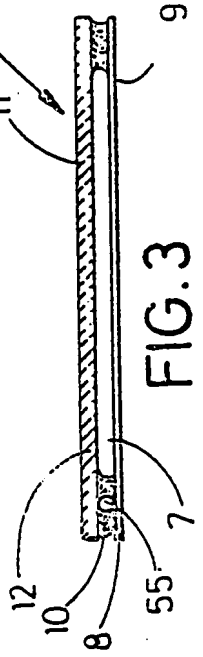

FIG. 3

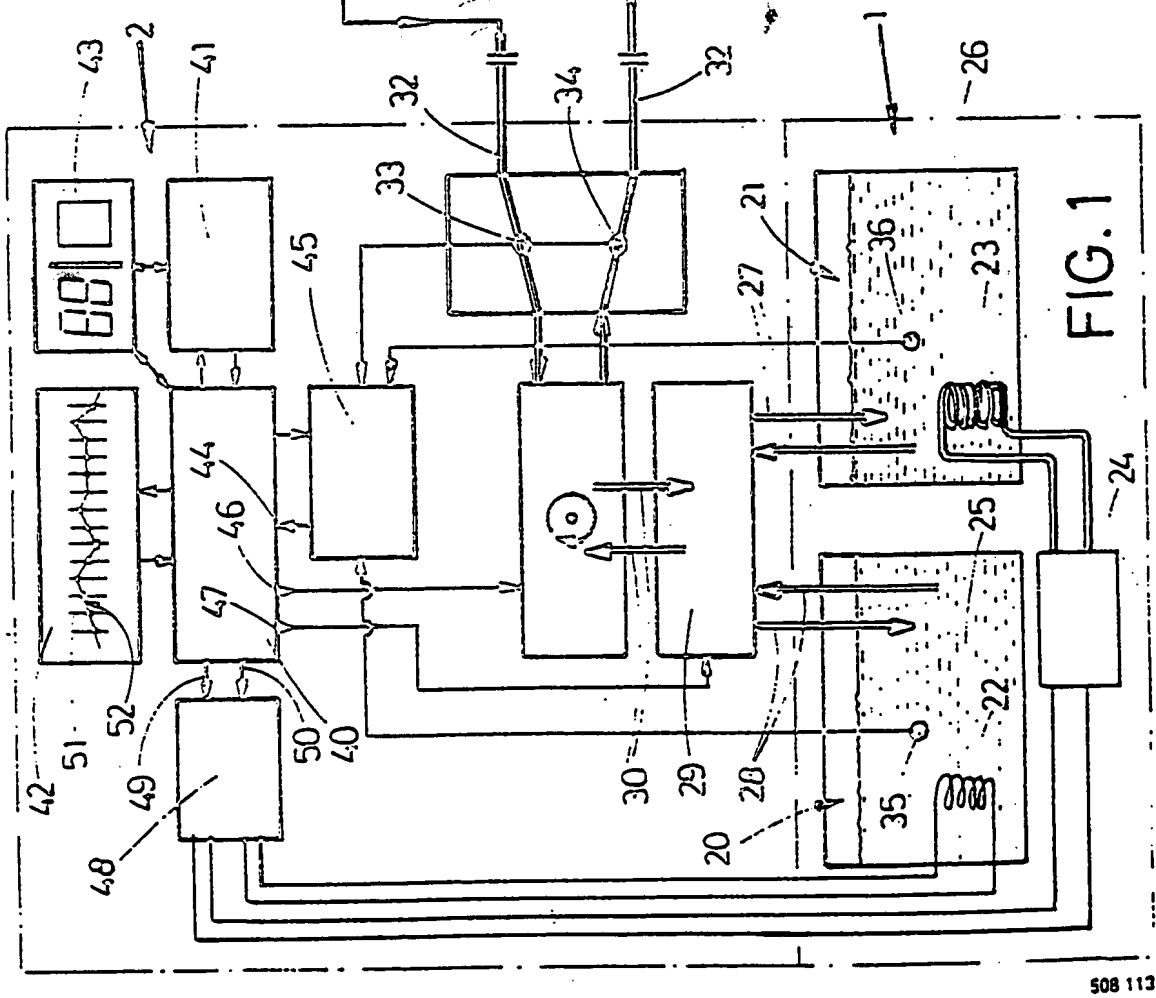

FIG. 1